Spatial and temporal seismicity clustering in Central-Northern Apennines: fluids and seismicity

P. Roselli[(1)], D. Piccinini[(1)], T. Braun, N.[(1)] Piana Agostinetti [(1)] e M. Ibs-von Seht[(2)]

[(1)] Istituto Nazionale di Geofisica e Vulcanologia, Arezzo
[(2)] BGR, Hannover

The Northern Apennines (NAs) are composed by a NE verging thrust-fold belt formed as result of the collision (Oligo-Miocene) between the European plate (Sardinia-Corsica block) and the Adriatic microplate, once the westward subduction of the Tethyan oceanic lithosphere was completed (*Alvarez, 1972; Reutter et al., 1980; Argnani, 2002*). This mountain chain is dominated by concomitant extension and compression in two adjacent areas: inner zone of the belt and outer zone (*Frepoli and Amato, 1997; Collettini and Barchi, 2002*). Our study area is located in the inner zone characterised by Pliocene-Quaternary sedimentation developed in grabens and half-grabens borded by normal faults. This tectonic extension process is associated whith diffuse CO_2 degassing (*Chiodini et al., 2004*). The question whether the CO_2 has a metamorphic and/or magmatic upper crust origin is more debated (*Minissale et al., 2000; Chiodini et al., 2004; Minissale, 2004; Heinicke et al., 2006*). Instrumental seismicity is concentrated in a relatively shallow layer that deepens from the internal to external areas (*Chiarabba and Amato, 2003*). High fluid pressures (85% of the lithostatic pressure) encountered at shallow crustal depth suggest that deep fluids from deeper layers could play a key role in triggering earthquakes (*Chiodini et al., 2004; Antonioli et al., 2005)* and seem to control also the spatio-temporal evolution of the seismicity (*Piccinini & Antonioli, 2007*). Our study area is confined by the Upper Tiber Valley (NSE), Casentino (W), Mugello (NW) and the Montefeltro seismic area (NE). We analysed the seismic events recorded both by the National Seismic Network (1981-2001, CSI 1.1; data-set was extracted online, http://www.ingv.it/CSI/) and by two temporal local seismic networks installed by INGV-Arezzo Observatory (OSCAR) during 2002-2003 (CAESAR experiment) and 2005-2006 (M88-2005 experiment). In order to obtain a better azimuthal coverage we integrated this data-set with on-line database of the Rete Sismometrica Marchigiana (DBRSM, http://protezionecivile.regione.marche.it/dbrsm/) and the monthly seismic bulletin of the INGV. We extracted the events located inside the area of interest in order to retrieve a detailed local 1D velocity model used for successive location with VELEST-code (*Kissling et al., 1994*) and relocation using HYPOELLIPSE (*Lahr, 1989*). We discuss the main seismicity patterns of several seismic clusters by integrating the results of previous studies with newly determined hypocentral locations and focal mechanisms. Our results are interpreted as a function of the historical seismicity, the structural and geodynamic setting and the carbon dioxide degassing.

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